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Gold deposit in the Cikidang area, West Java, Indonesia

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Abstract: The Cikidang gold deposit in West Java is located within the Bayah Dome Complex, hosted in the Cimapag Miocene Volcanic Formation. It is typical of a low-sulphidation epithermal deposit, consisting of several veins up to 1 km across with 180°–210° trend, 0.7–2.7 m widths, and about 60°–80° dips to the west.

The veins are composed of disseminated and clusters of native gold, quartz-adularia-calcite assemblages, showing various textures such as colloform banding, vein breccia, comb texture, and rare massive texture. Gold and silver average grades are 11.80 g/t and 72.23 g/t respectively; the Ag/Au ratio is about 7. The proven ore reserve is 475,698.74 ton.

Hydrothermal alteration is widespread in the Cikidang veins; advanced argillic alteration extends from 1 m up to 10 m around the veins, and is gradually changed to argillic and propylitic alteration outward from the vein.

Fluid inclusion evidence indicates the mineralising fluids had temperature ranges from 175° to 210°C, salinities between 0.028 to 1.07 eq. wt % NaCl. Besides, the mineralization horizon of the Cikidang vein is located in the precious metal horizon.

The age of the mineralization is around 2.1–1.5 Ma (Plio-Pleistocene).

INTRODUCTION

Cikidang is located in West Java, about 180 km west of Bogor (Fig. 1), in an area of moderate to steeply dipping mountainous, and hilly topography with an average elevation between 875 m up to 1,423 m above sea level. This is a state mining project undertaken by P.T. Aneka Tambang (ANTAM), situated in an area between the other two state minings, the Cikotok- and the Pongkor-mines within the Bayah Dome Complex (Fig. 2).

This Cikidang deposit (CKD) is believed to be a low-sulphidation vein type epithermal gold deposit and probably has much similarity to the gold deposits in the Pongkor area. Preliminary study on the geochemical data indicates an Au stream sediment anomaly up to more than 45 ppb (in 1988); followed by several discoveries such as the discovery of hypothetic ore reserve about 473,000 ton with the ore content of gold and silver 10 g/t and 87.60 g/t respectively.

Other discovery includes the finding of the Cikidang vein (Cibanteng-Cibodas vein) with ±900 m length, 1.5 m width showing promising gold content of up to 7 g/t. All of these mentioned Au discoveries resulted from exploration efforts made by the joint cooperation between DMR-BRGM and P.T. Aneka Tambang between 1987–1991. During 1993–1994 this preliminary exploration efforts were followed up by P.T. Aneka Tambang (Geologic Unit) and the UPEC team coming out with the latest discoveries.

GEOLOGIC SETTING

West Java area is the western segment (instead of Sumatra and possibly part of central Java) of the Sunda-Banda arc described by Carlile and Mitchell (1994); this arc is the longest arc in Indonesia, extending from north Sumatra through Java to east Damar. It is a continental arc margin which developed along the north-western margin of the subducting Indian-Australian plate following collision with the Eurasian plate during the Cenozoic. Available K/Ar dates suggest that the volcanism/magmatism related to this subduction took place in two distinct periods: late Eocene to early Miocene and late Miocene to Pliocene (Soeria-Atmadja *et al.*, 1991). The first volcanic event produced the so-called "Old Andesite Formation" mentioned by van Bemmelen (1949), whereas the latter volcanic event gave rise to medium to high K

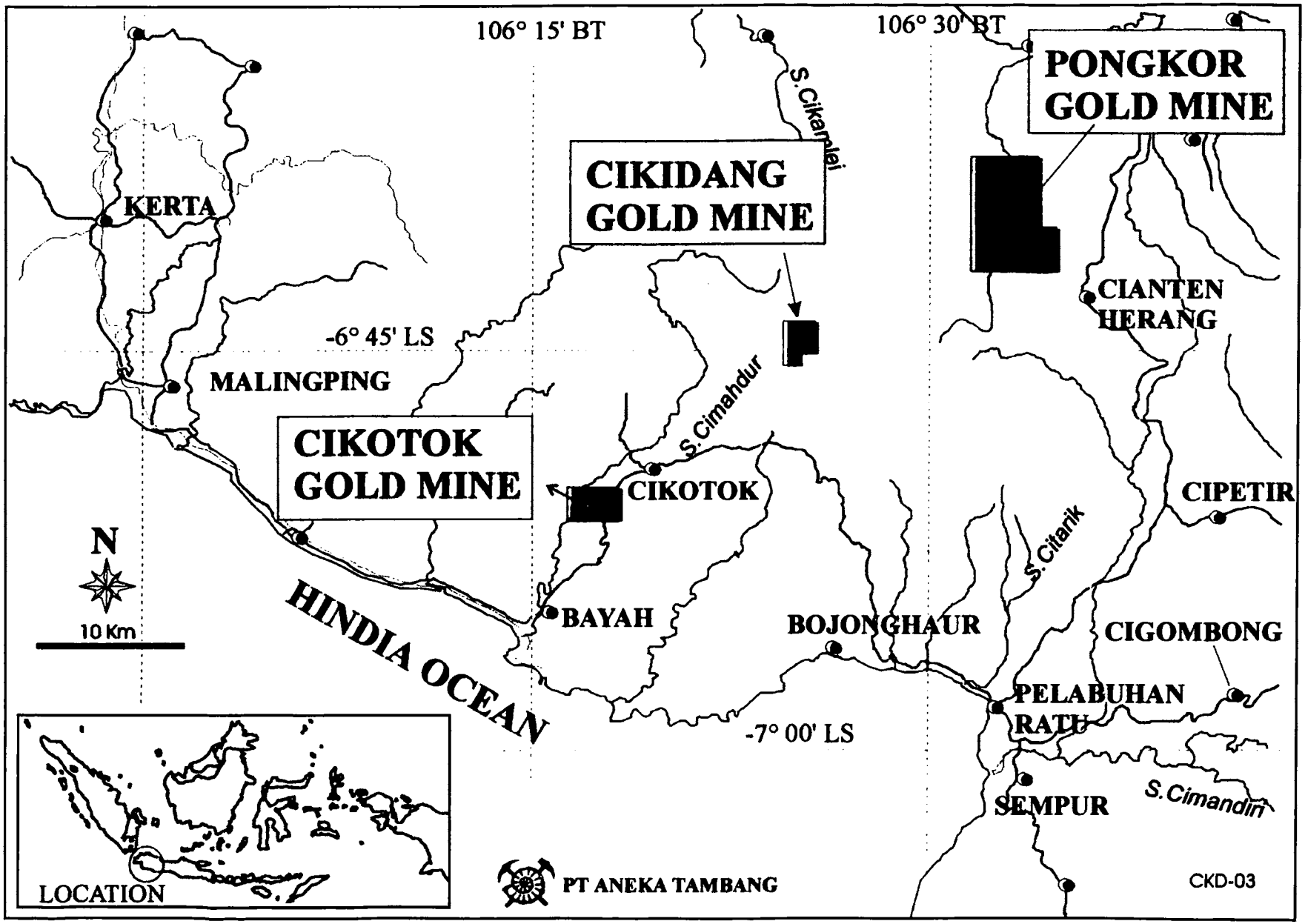

Figure 1. Location map of Cikidang prospect, West Java.

calc-alkaline volcanic products. Gold mineralization in Java is generally related to this Neogene volcanism.

Stratigraphically the Cikidang area consists of 3 (three) rock units (Fig. 3): the sedimentary/ epiclastic rock (the lowest rock unit found in this area), the volcanic rock, and the intrusion unit. The sedimentary unit is characterised by alternating clay and sandstone showing 15° dip to the south. This unit is comparable with the lower part of the Cimapag Formation, deposited in a marine to non-marine environment. Overlying this sedimentary unit is the most abundantly distributed volcanic rock unit. It consists predominantly of polymic tuff breccia intercalated with lapilli tuff and andesitic tuff and sometimes with epiclastic rocks dipping about 5°–15° towards the south too. A subaerial environment of deposition is indicated by the presence of common silicified wood. This unit is correlated to the upper part of the Cimapag Formation of the early Miocene age. The third unit, the andesite intrusion cuts the Cimapag Formation (Fig. 4).

The dominant structural trends are N-S and E-W. The N-S structure is represented by faults whilst the E-W structure is dominated by folded area giving a hilly topography. Two different episodes of structure related to mineralisation are classified: the pre-mineralization and the post-mineralization structures. The pre-mineralization has N185°E-N210°E trends, dipping 65°–85° to the NW; most of them are infilled producing mineralised quartz veins (e.g. the Cikidang, Tengah, Timur, and the Barat veins). The post-mineralizatian structure can be identified by the presence of slicken sides in the river branch of S. Cibodas, showing an E-W trend. The age of this structure is probably post late Miocene.

ALTERATION AND MINERALIZATION

Four vein systems are found in this area; the Cikidang (the main vein system), the Tengah, Timur, and the Barat veins (Fig. 3). The Cikidang veins can be traced across the area of several meters up to 1 km with N185°E-210°E trends, and show

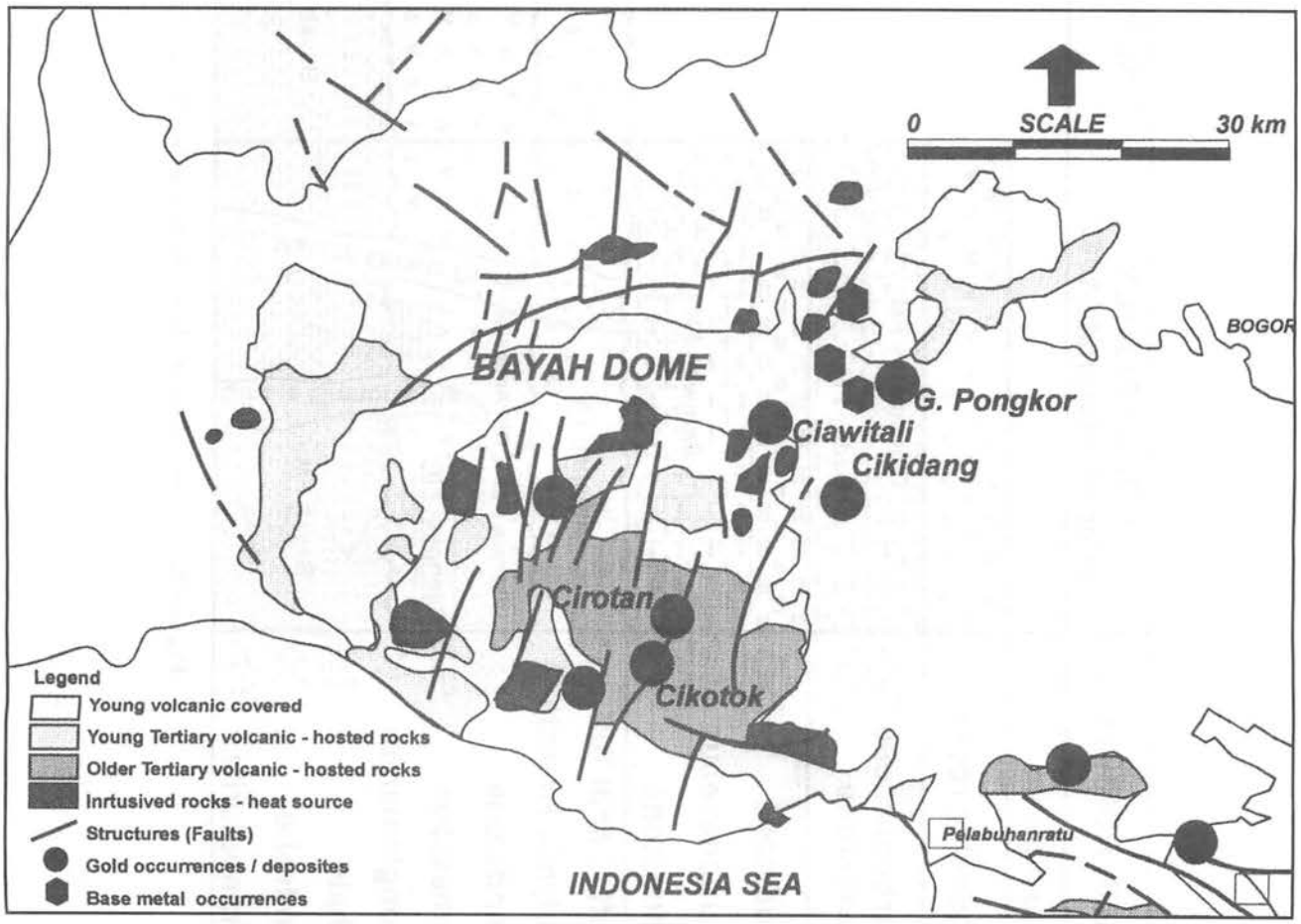

Figure 2. Geology and location of gold deposits in the Cirotan and Ciawi Districts, West Java, Indonesia.

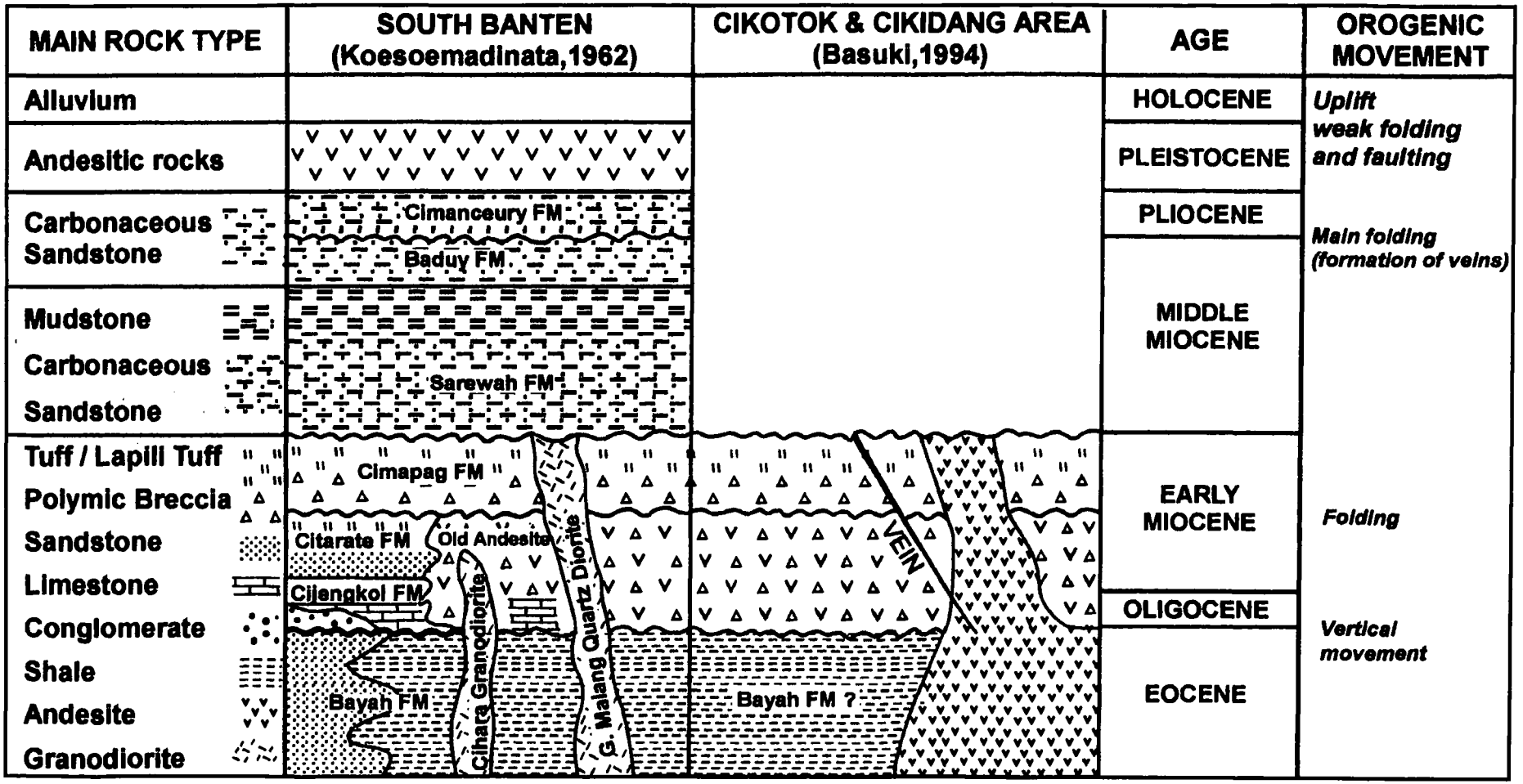

Figure 3. Stratigraphic correlation between the Cikidang area versus South Banten area (Basuki *et al.*, 1994).

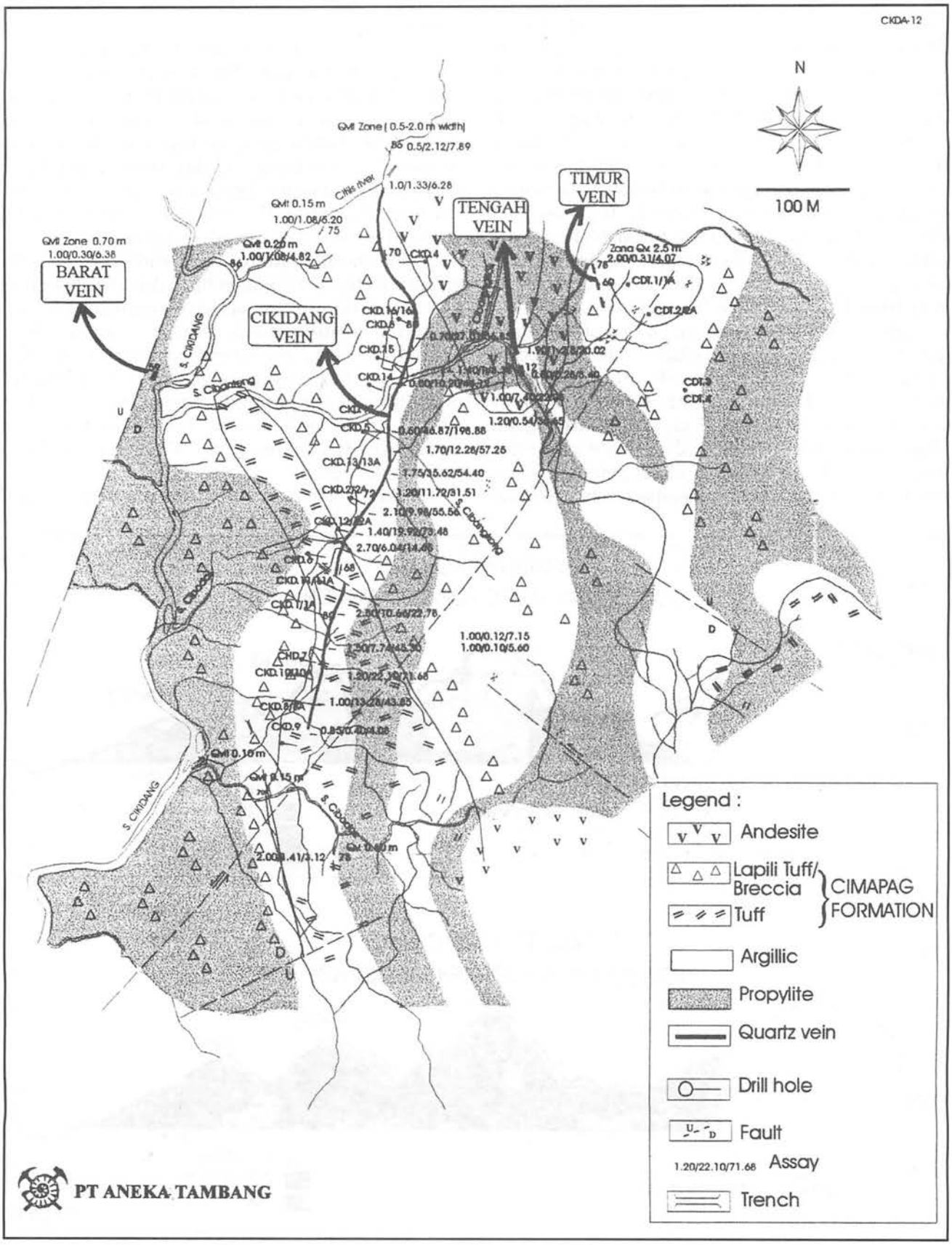

Figure 4. Geological and alteration map, Cikidang prospect, West Java.

60°-85° dips toward west. The width of these veins vary from 0.70–2.70 meters. Gold and silver grades within the veins vary from trace to 54.42 g/t (ave. 11.80 g/t) and from about 1.88 g/t to 115.68 g/t (ave. 72.23 g/t} respectively. Ag/Au ratios range between 3 to 50 with an average of 7. Base metal (Cu, Pb, Zn) values are negligible (trace to 0.02 ppm). The ore reserve is 475,698.74 ton, whereas the metal reserve is 5,615 kg for Au and 34,360 kg for Ag. Detailed gold distribution and the quartz thickness along depth are shown in Figure 5. It is seen that the gold distribution decrease towards the deeper parts whilst the thickness of quartz vein is irregular; no regular pattern can be traced; the thicknesses vary from 1 to more than 3 meters.

The Cikidang veins are composed of abundant quartz, lesser amounts of carbonate (dominated by calcite), adularia, clay minerals (illite, kaolinite) manganese oxides and limonite. Gold is present as very fine-grained anhedral crystals (native gold) about 200 microns in size, and is closely associated with silver. The average grade of gold and silver are 11.80 g/t and 72.23 g/t respectively. Several types of textures noted within the vein include banded, colloform, comb, breccia, and massive textures.

The Tengah, Timur, and the Barat veins are veins of less potential. The Tengah vein outcrops in an area of 50 meters trending N180°-200°E and dipping 60°–76° to the west. This vein is also marked by widths ranging between 10–100 cm, composed predominantly of clay, quartz, and clasts of wall-rock, showing breccia texture. Gold and silver grades within the vein vary from 0.54 to 12 g/t and between 3.4–108 g/t respectively.

Hydrothermal alteration is widespread in the vicinity of the Cikidang veins. Advanced argillic alteration (kaolinite, sericite, alunite, quartz, adularia, calcite) extends from 1 m up to 10 m around the vein; it gradually changes to argillic alteration (illite-smectite) across 5–10 m width, and propylitic alteration outward from the vein. The latter can be observed in several outcrops of andesitic tuff along S. Cibodas and S. Cikidangleungsir.

Fluid inclusion measurements are carried out

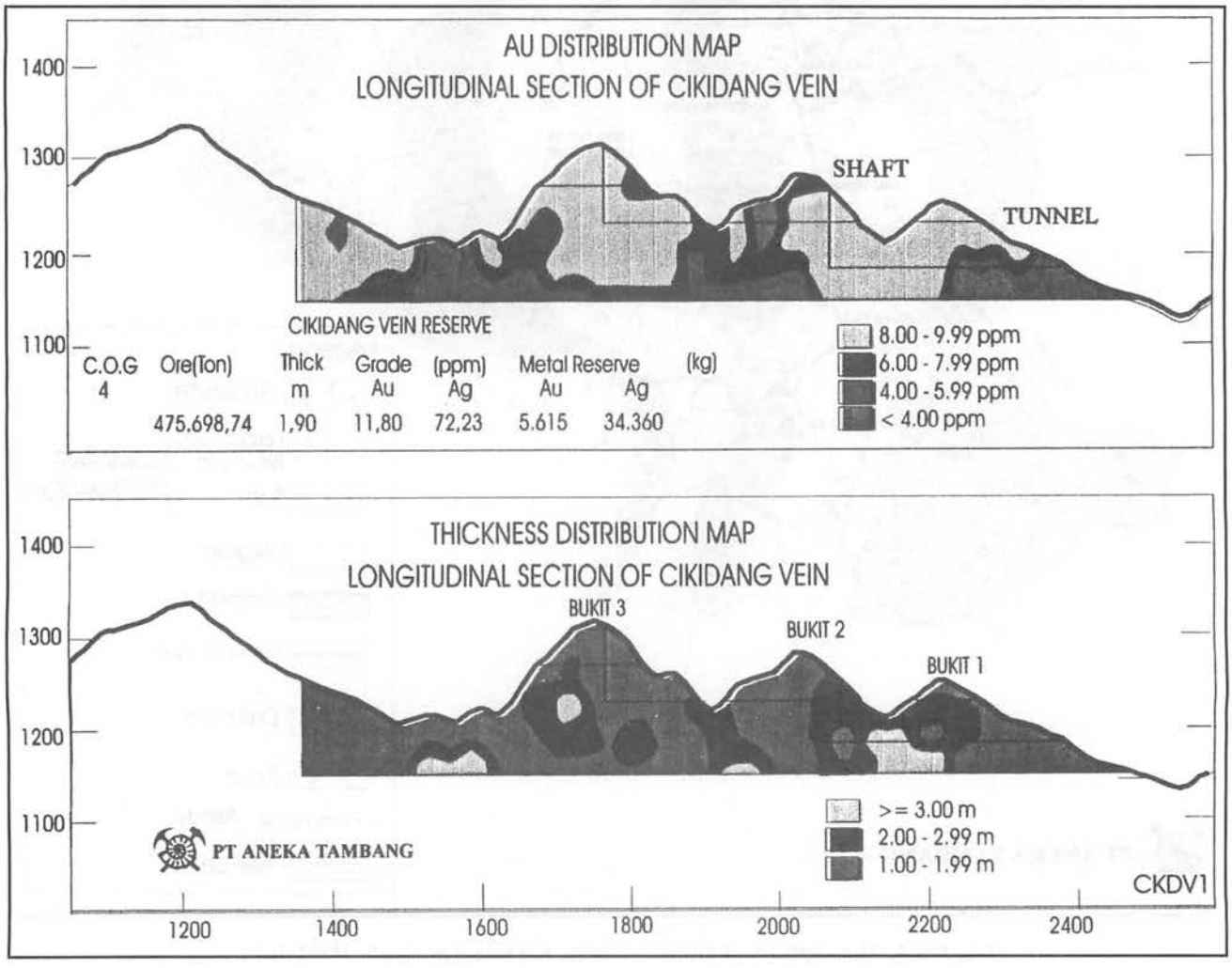

Figure 5. Detailed gold distribution and the quartz thickness along depth.

on 10 (ten) samples from mineralized quartz veins of the Cikidang vein system. This analysis reveals three types of inclusions: the magmatic-, the primary, and the secondary liquid-rich inclusions. Magmatic liquid-rich inclusions (2 measurements) homogenised at temperatures between 360°–373°C with salinity in excess of 1.07 eq. wt % NaCl. Eight measurements on primary and secondary liquid-rich inclusions indicate that they homogenised at temperatures between 196°–250°C and between 165°–197°C respectively. The salinities range between 0.028–1.07 eq. wt % NaCl.

DISCUSSION

The Cikidang gold deposit is one of thirteen other locations of Au mineralisation found in the Bayah Dome Complex. Most of the gold mineralization is hosted by the volcanic rock of the so-called "Old Andesite" and the Cimapag Volcanic Formation of the Oligo-Miocene age. A few of these mineralizations are probably hosted by sedimentary rock. This CKD has much similarity to those of Pongkor gold deposit. These two Au mineralizations belong to low sulphidation vein type epithermal deposit, characterised by the associated Au-Mn within the veins. Other distinction compared to the other gold deposits found in the Bayah Dome Complex [for example the Cikotok (CKT) and Cirotan (CRT) deposits] is the lack of base metal. The Pongkor and the CKD gold deposits are situated within the eastern/northern part of the Bayah Complex; they are situated more in the NE side of the Citorek depression (Fig. 6) whilst the CRT and CKT deposits are situated rather to the south/SW of this depression. It seems that going in the south/SW direction from the Citorek depression is dominated by the "Cirotan type" deposits whereas the northern/NE side of the depression is characterised by the so-called "Pongkor type" deposits (these two mentioned types are adopted from Marcoux and Milesi, 1994). In addition the

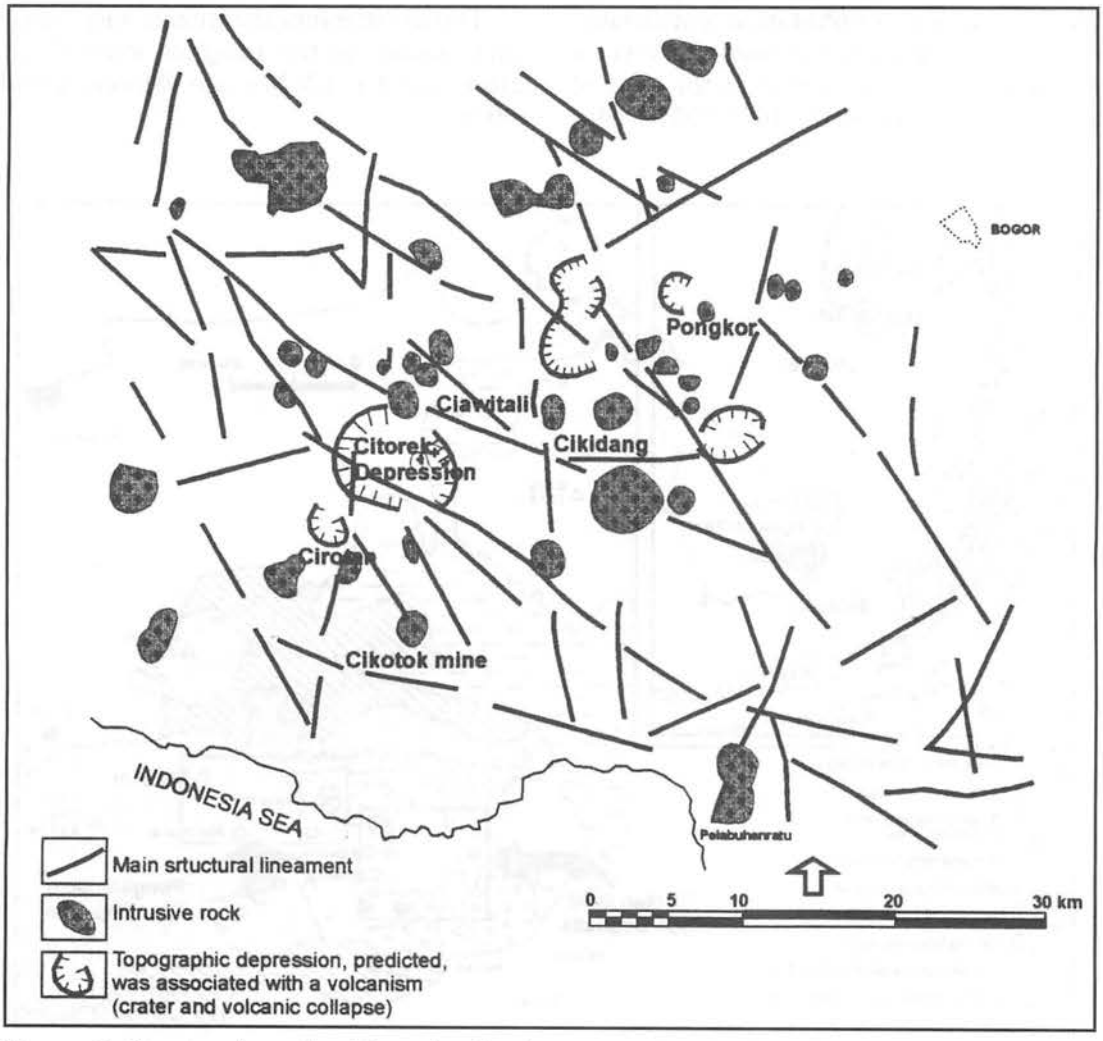

Figure 6. Structural trend and intrusion development within the Bayah Dome Complex (modified from P.T. Aneka Tambang unpublished report, 1994).

general structural trends of both the CKD deposit as well as the Pongkor deposit are N185°–210°E and about N330°E respectively, following the regional CRT trend. It could be concluded then that, the CRT-CKT deposit system and the CKD-Pongkor system can be classified as two different "cluster zones"; the Cirotan and the Pongkor cluster zones. These two clusters are divided by the Citorek depression (Fig. 7).

CONCLUSION

The CKD gold deposit was formed by hydrothermal systems associated with the intrusion of Plio-Pleistocene age into the Old Andesite and Cimapag Formations. The latter have an age of Oligo-Miocene time. It consists of 4 (four) vein systems of the tension- and shear-filling veins: the main Cikidang vein, the Tengah, Timur, and the Barat veins. Based on its gangue mineral assemblage (adularia-sericite), the lack in base metal within the veins and its textural characteristics indicate that this CKD deposit can be classified as a low sulphidation epithermal deposit. Besides fluid inclusion analysis reveals that the temperature of the liquid at the time of gold formation ranges between 165°–205°C with salinities varying between 0.028–1.07% wt NaCl. This result gives the mineralisation zone prediction at the level of the precious metal horizon of the Buchanan (1981) diagram. The proven ore reserve is 475,698.74 ton with ore grades of 11.80 g/t for Au and 72.23 g/t for Ag; Ag/Au ratio is about 7. The distribution of gold is varies vertically; it decreases towards the deeper parts; whilst the thickness/ width of the quartz veins are irregular.

The CKD deposit is situated in the northern side of the Citorek depression; the general structures indicate N185-210°E directions, following the CRT trend. It has much similarity to those of the Pongkor gold deposit (the occurrences, the mineralisation type, the structural pattern); thus it can be grouped together with the Pongkor deposit (and other areas of the same Pongkor type deposits e.g. Ciawitali, Nirmala) as a distinct cluster zone namely the "Pongkor cluster zone" instead of the other "Cirotan cluster zone" (Cirotan, Cikotok, and surrounding areas) (Marcoux and Milesi, 1993; Marcoux *et al.*, 1996; Sunarya *et al.*, 1992) which is situated in the south/SW of the Citorek depression.

The age of mineralization is suggested to be the same period as the Pongkor mineralization; the latter has 2.1–1.5 Ma age (Marcoux and Milesi, 1994).

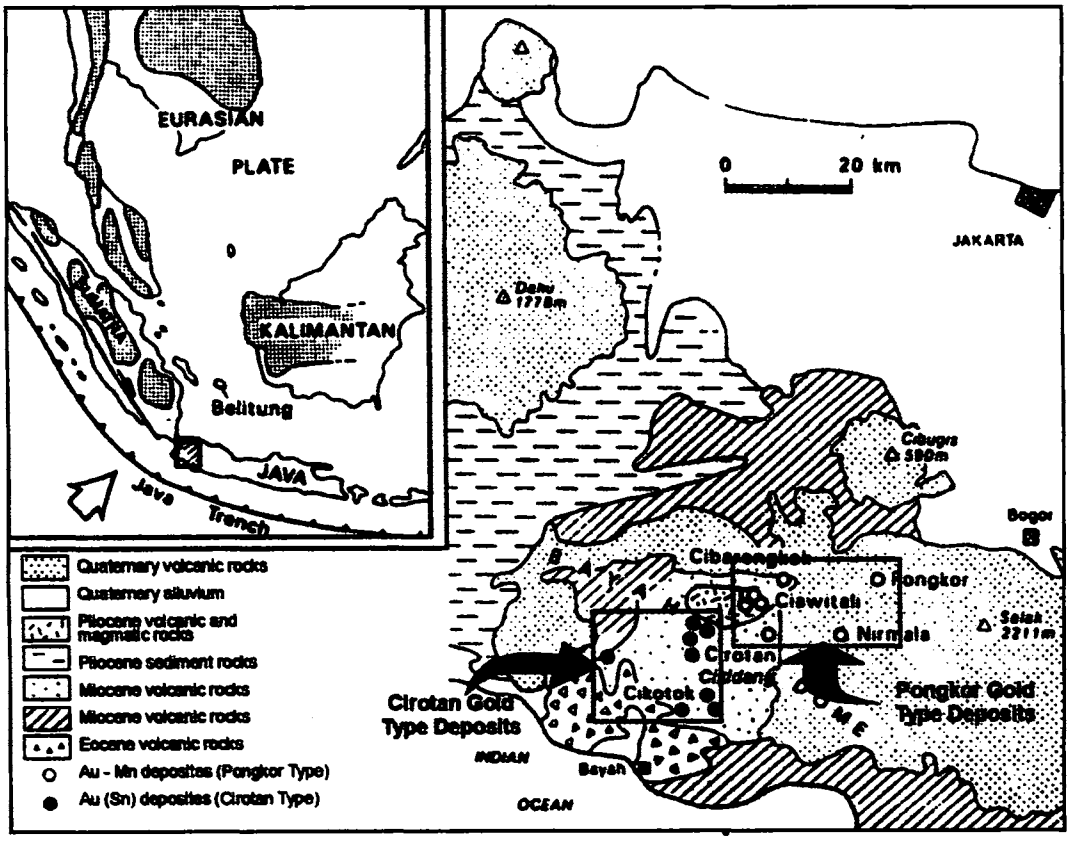

Figure 7. Cluster zones of gold deposits in the Bayah Dome Complex, West Java (modified from Marcoux and Milesi, 1994).

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